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ABSTRACT

A one-year study is being conducted to provide a comprehensive, empirical definition of the factors that produce inequitable access to computers and computer knowledge for women, to generate a list of potential solutions to this problem, and to develop a self assessment instrument for use by educators to identify the inequitable access factors operating in districts and/or classrooms. Information on 350 critical incidents--situations where computer use and access were limited for some students--has been collected from educators, students, and parents of students at 12 elementary and junior high schools. The findings halfway through the project indicate that: (1) computers have not found a place in the curriculum; (2) computer technology seems to generate enthusiasm for both very creative and routine tasks; and (3) many students do not understand what they are supposed to be learning on the computer. Gender-related findings are illustrated by means of personal narratives, e.g., females confronted by impediments to computer exposure, female difficulty in maintaining an interest in software content, and fewer opportunities for females to gain out-of-school experience with computer technology. Female perseverance in computer use is also illustrated. A nine-item bibliography is provided. (ESR)

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FEMALES AND MICROCOMPUTER USE IN SCHOOL:
some insights into traditional patterns

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Females and Microcomputer Use in Schools:
Some New Insights Into Traditional Patterns

The issue of equity and computers is receiving increasing attention. For some, the computer has created a new awareness and sensitivity about equity. Educators who were reluctant to notice any inequities just a short time ago now look for remedies to combat inequitable practices related to computer access and use. Recent studies have revealed several dimensions to the issue:

1. Inequity and economics. Wealthier communities tend to have more microcomputers in schools than do poor communities; (Quality Education Data [QED] 1982)

   Middle to upper income homes have a higher proportion of home computers than lower income homes; (QED 1982)

   Students from higher income homes more often attend computer camps and private computer classes; (Hess & Miura, 1982)

2. Inequity and region. Students who live in the Southern part of the U.S. are less likely to use computers than their counterparts in the Central, North, and West regions (National Science Assessment 1982)

3. Inequity and intellect. The "brightest and best" sharpen their intellectual skills by problem-solving and programming, while the less gifted students practice word association and math problems (Johns Hopkins Summary #3, October 1983)

4. Inequity and implementors. In schools where groups of teachers or administrators share implementation responsibility, there is more parity in micro use by above and below average students than in schools where a single teacher is the lead implementor. (Johns Hopkins Report #4 February 1984)

5. Inequity and funding. Schools that purchase micros with federal grant money have less flexibility in how computers are used (typically to teach basic skills a la drill and practice) than do schools with private sources for computer purchase with "no strings attached." (Access Without Success, Newsweek, 19 March 1984)

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6. Inequity and ethnicity. Schools with a larger percentage of minority students have fewer computers than racially mixed or all-white schools (Quality Education Data, 1982); in Alexandria, VA, minority participation at the elementary level is higher for minorities than white students, but students in the advanced computer classes are mostly white. (Education Daily, 28 February 1984)

There has been little systematic examination of inequity and gender. Most of the findings report on discrepencies in enrollment patterns that reveal a higher proportion of males in computer classes and programming classes at the secondary level (Anderson, Klassen, Krohn, & Smith - Cunnien, 1982) or survey the extent of female interest and awareness in micro-computers. The California Assessment Program found that 12th grade males scored higher than females in knowledge of computers and their use. Females at both elementary and secondary level believe computers are important in their future. Young females show an interest in the technology and want to gain exposure to it; but something happens as females grow older that results in dwindling participation in computer-related activities. We need to know more about the circumstances surrounding access to computers and how the technology is used in order to pinpoint opportunities for realistic and practical strategies to combat inequities.

How is AIR Addressing the Equity Issue?

We are mid-course in a one-year project entitled Practical Solutions To Overcoming Inequitable Computer Use. The project's goals are to:

- o provide a comprehensive, empirical definition of the factors that produce inequitable access to computers and computer knowledge for women and minorities;
- o generate a list of potential solutions that would result in equitable access; and
- o develop a self-assessment instrument for use by educators to identify the inequitable access factors operating in districts and/or classrooms.

The central feature of the AIR approach to examining the gender gap in computer use and access is the identification of the circumstances and situations that limit access for some students. The procedure is to collect "critical incidents" from participants--educators, students, and parents--in which they describe activities that "made a difference" in terms of behaviors and their counsequences. The activities must be stated completely enough so that someone who was not present during the activity can understand what happened. By emphasizing behaviors, this approach allows the participants to describe experiences or events that happened to them or which they observed happening to others. During the past several months, we visited 12 elementary and junior high schools (selected for type of computer program, ethnic enrollment, and willingness to participate) to observe and talk to students and educators (faculty, lab/center coordinators). The focus was on computer-related activity in grades one through nine in learning environments such as computer laboratories and centers as well as individual classrooms.

Guided by individual school schedules and instructional programs, we either personally interviewed participants (at times convenient to the respondents) or met participants in a small group to record significant events. We observed younger computer users at the terminals and we met them in small groups away from the terminals where we talked to them about their computer experiences. All conversations are confidential; individual responses will not be traceable to a single participant.

Educators who participated in our study were asked to consider whether or not they could describe events:

- o when a student tried to enroll in a computer class and was not accepted;
- o about how students gain access to a computer during a free period such as lunch or before/after school;
- o when there are more students who want to use the computers than there are machines available;
- o about how students interact with one another while using the computers;
- o when they perceive a student's access to a home computer has made a difference in the student's use of computers in school.

Individuals provided examples of personal experiences in one or more of the suggested areas--or other areas they recalled. We asked people to tell us about their own experiences or ones they observed or knew about that happened to others. In order to understand each situation described, we elicited as much information as possible about each incident--what happened, who was involved, the circumstances surrounding the event, any immediate consequences, and whether or not there were long-term implications. While a situation that happened to only one individual may not be viewed as significant, patterns emerge when the occurences are examined collectively. We have collected approximately 350 usable incidents:

- o evenly divided between students and educators;
- o about twice as many females as male students
- o approximately 25 percent minority students
- o slightly more than twice as many female as male educators

How Do Critical Incidents Inform?

The following example illustrates a "critical incidents".

A computer center coordinator in a middle school posted sign-up sheets outside the center every Monday morning so students who wished to could use the facilities before and after school. The ratio of males to females who signed up was overwhelmingly high and one reason was that males were more aggressive in getting to the sheets to sign up. The females did not fight back, thereby losing chances for extra practice on the computers.

The faculty member recognized an imbalance in access to the centers for the females. So what, one might respond. The females had the same chance to sign up as the males. Perhaps. But behavioral differences interfered with the females taking advantage of the situation--stereotypic responses, if you will. They lacked aggressiveness. If such occurrences take place frequently (whatever explanations are offered), they are important because of the impact on the students, and in many ways other than being excluded from a computer center.

In this case, some form of regulation or monitoring was necessary for the young women to gain access to a computer center. The faculty member took steps to redress the situation (male and female days), but it was the awareness of the "incident" that led to this change.

Our conversations with students also yielded informative incidents. These examples show the effect of parental influence on a student's opportunity for computer use.

> One young man took his first computer class a year ago. He has made rapid progress and taught a computer class to adults during the summer. He purchased his own computer with the profits, and is also trying to market his own software. He currently edits the school yearbook on an IBM personal computer in the school computer center. He says his parents encourage him in his efforts and do not mind that he spends most of his evening at his computer, sometimes long into the night.

A less supportive example:

> A seventh grade computer student (female and minority) told us her parents do not want her to read computer magazines at home, although she says that her brother, who is one year older, is strongly encouraged to read this literature. They view computer interests and activities as inappropriate for women. For this young woman, whose father works for a computer company, the opportunities for learning about the computer's capabilities are vastly different from those of the young man described in the previous example and apparently from those of her brother. Nevertheless, she has excelled at computer programming and demonstrated one of her graphics programs to us while we talked.

These two students' experiences provide insight into the impact of the home environment. Under what circumstances do parents support their children's desires to learn about computers? Do parents attempt to discourage their daughters from this field for one reason or another, and what are these reasons? Do some parents attempt to get their daughters interested in educational technology? Is there a difference between the way parents encourage their children in families with both a boy and a girl?

We have gathered a sufficient number of significant incidents to begin sorting the data to see what patterns emerge. Creating a taxonomy is an empirical process that rests on a judgment of "alike or different." The

analyst reads a second incident and judges it to be alike or unlike the first one, according to a single dimension, such as lack of access to computer labs during free periods. Additional dimensions may be added to determine patterns among certain populations, grades, or subjects. Each incident in turn is judged to be "like" one or more previous incidents or "unlike" all of them. Each judgment of "unlike" introduces a new category in the taxonomy. An analyst continues until reasonable confidence exists that no new categories will emerge. Reliability checks to reduce chance error and demonstrate consistency must be conducted. We might learn, for example, that fifth graders who want to use a computer during their lunch period have special problems; or certain types of students developed strategies for usurping another student's allocated time on the computer; females tend to use a computer for more drill and practice exercises than males; or that certain procedures enhance computer use in a computer center that do not occur in a classroom.

What Have We Learned Thus Far?

The findings to date reflect (1) our overall observations and impressions during the visits to the schools and (2) preliminary sorting of the data into descriptive events and the contextual circumstances. Some illustrations follow.

1. Computers haven't found a space in the curriculum. This is especially true at the elementary level where the pressure "to do something" with computers and the frequent reliance on a key actor to assume responsibility has led school districts to set policies and establish programs with little attention given to what the curriculum goals of such programs should be and with little involvement of teachers in the implementation. In one year, the number of public schools with computers has doubled: few schools are without at least one micro. Few innovations have been accepted by the schools with a comparable sense of urgency. Yet, the necessity of installing the technology has resulted in almost as many approaches to choosing content and scheduling computer time as there are school computer programs. A fourth grade student in one school may be using Logo while her counterpart in a neighboring district may be practicing multiplication tables. Some students may learn to create stories on a computer while others never do more than follow directions given by the machine. Some students are guaranteed minimum exposure to a computer each week while others must earn their time. What all this leads to isn't very clear right now. But the assumed promise is not yet reflected in a school commitment to integrate the computer as a component of the educational program.

2. The technology seems to generate enthusiasm for both very creative tasks as well as some routine ones. Students enjoy seeing their programs run on the screen, inputting correct answers, or solving problems. I believe that it's appropriate for students to practice math computation on a micro when they find the same tasks boring using a paper and pencil at their desk. They experience success in the subject, plus comfort and familiarity with the machine. For those who say such technological uses neglect the full potential of the computer, I would simply point out that no tool is only used at full capacity. For some students, drill and practice may be an entirely appropriate use of the computer.

3. Many students don't understand what they're supposed to be learning on the computer. In some instances, they are "translating information into terms the computer can understand" ... "an intellectual assembly line (Streibel, Education Daily, 21 February 1984). During our visits, we noticed fourth graders using turtle graphics with little awareness of the concepts they were applying and scant attention by the instructor to establish the relationships. Recently, students who had one year of Logo programming were no more able to apply programming concepts to an assigned task than a matched group of students with no programming background. The investigator, R. Pea (Bank Street) commented that children displayed "production without comprehension." (Menosky, 1984).

Our critical incident data reveal some occurrences that others have found--e.g., females confronted by impediments to computer exposure that are not experienced by their male counterparts, female difficulty in maintaining an interest in the content of the software, and fewer opportunities for females to gain out-of-school experiences with the technology. But the nature of critical incidents permits us to learn more about such categories. The elaborations should help to frame solutions to the imbalances. In fact, one of the most promising features of our data is that for each category of inequity, we have examples of successful counter-measures. For example, we learn that females have fewer opportunities to use computers at home than males, but we also discovered that some girls persevere to open doors of opportunity. A particular example:

- A student (Sally) uses a friend's (Patricia) computer because there is no computer in Sally's house.

We learned that Sally is gaining additional exposure to a micro. But what we learn from the incident that we would not learn otherwise is that:

- the friend (Patricia) had little interest in learning to use the computer;
- the girls worked out an arrangement whereby Patricia received help with the dishes on Tuesday and Thursday in exchange for allowing Sally time on her home computer;
- as a consequence of Sally's work at the computer, Patricia is now beginning to use the micro, with Sally's help;
- Patricia's parents are delighted with their daughters interest and Sally's role in developing that interest.

We also discovered that some skills traditionally linked to females can be used to advantage when acquiring computer savvy. Typing, for example, facilitates keyboard agility. Those who know how to touch type (usually females) can input data faster than those who hunt and peck. The incidents tell us that:

- those who type may assume leadership roles when working with a partner (students may be active in entering data or, as in one instance, one student gave her female partner private lessons on the home computer to teach keyboard skills).

- o some males are enrolling in typing class to increase speed in using the computer.

Typing is becoming valued by more and more people as a desirable entree to the computer.

The influence of parents and the home on computer learning is widely recognized--parents more often purchase home computers for sons than for daughters; more often males attend computer camps; daughters are less encouraged to stay after school; and so forth. Our data agree that parents tend to encourage males; but many parents (both mother and father) also encourage daughters. In dual parent homes, the father is typically the role model - but what we've learned is that some very new father/daughter relationships have formed. Daughters may visit the father's office to work with the computer; one female student only worked on the family computer with her father.

> One girl had little "rapport" with her father; they didn't seem to have much in common. The student (4th grader) says things are good now because the family has a computer. She is interested in computers and her father knows how to operate the machines so they spend time together using the micro. The improved relationship makes the girl very happy.

In such situations, mothers may support the daughter's computer enthusiasm but seldom act as the role model.

In single parent homes, however, we have several incidents of mother as the role model--employed in the computer industry, purchased a home computer which she uses with her children, or pays for computer classes after school.

> A female student (7th grader) does not have a computer at home but her mother feels it is very important for her to learn about computers. She strongly encouraged the child to enroll in the introductory course and has suggested that her daughter consider a career in word processing. The mother plans to purchase an Apple in the near future. An older sibling (female) at home is also interested in computers.

The data contain instances of female shyness and reluctance to ask for assistance with the technology. But we have several examples of student initiatives their teachers describe as breakthroughs. Some interest in computer proficiency overcomes a reluctance to seek assistance.

> A fifth grade female in the extended learning program is having trouble constructing her program. It is very hard for her: the girl is shy and reluctant to ask for help. But she is very interested in learning how to use the computer and enjoys the things she does with it. The teacher says that she is learning to request help in writing her programs because she wants to be proficient on the machine. Teacher believes this is a breakthrough for the student.

Another type of breakthrough occurs with average and below average ability students who successfully instruct their peers. In one incident, a teacher who resisted using average ability students learned they were very capable networkers and student aids. There is a tendency for educators to select the "best and brightest" for some of the extra roles, often males rather than females. We also have several examples of 4th and 5th grade slow learners helping 1st and 2nd graders--patiently and clearly explaining procedures to the younger students. They seemed very in touch with the learning process - we found no gender differences among these examples.

Student enrollment in elective computer classes can be influenced by earlier exposure in compulsory computer class. The male coordinator of a 7th grade class remarked that when the computer lab opened, few females enrolled. During the second year, he noticed an increasing number of females began to sign up for his class. When we spoke to the students, we learned that many had come from the 6th grade feeder school with a mandated computer class and both female and male students wanted to learn more. Early exposure seemed to make a difference in willingness to continue computer learning.

One final example. The power of the peer! It can help or hinder a computer learner. Again, some parallels of traditional stereotypic patterns emerge, such as male dominance in tutorial and partnership roles.

> Two students are working together on a computer. The boy is the tutor and is instructing the girl on how to figure out the design of a problem. The girl does not take the initiative, but rather asks the tutor what to do. Instead of giving her suggestions, the tutor types the program in for her. This procedure is repeated four or five times until the teacher notices what is happening. She (the teacher) instructs the tutor not to give answers or type the program but to assist the student with clues. Nevertheless, the tutor continues to do the problems for the girl after the teacher departs. The student is not learning how to program because she is not actively participating in the learning process. She has deferred the active role to the tutor.

But we have many striking examples of constructive activity that are cross-sex, same-sex, cross-ethnicity, and same-ethnicity.

> Two seventh grade female students were trying to work through the day's assignment on the TRS-80 and having trouble making the program run. A male student two machines away gave them instructions (from his machine) but they still couldn't get the program to run. He came over and performed the necessary operation, made certain all was OK and then returned to his work. I asked one girl if she remembered what he had done and she repeated the sequence on the micro. They said that they sometimes ask him for help because he is very good.

We also see capable students requesting opportunities to team with less able so they can instruct, slow learners demonstrating procedures to their counterparts and to younger students, friends influencing one another to join or not to join a computer club, labels of "computer nerd" diminishing the computer interests in order to be accepted by their peers. And so on....

Our analysis has begun and we have just scratched the surface. I have given some snapshots of what promises to be a more complete portfolio in a few months.

When we complete the data analysis, we will invite groups of educators and parents to meet for a one-day brainstorming session to review the findings and generate ideas for realistic and practical solutions and how they can be implemented. One component of the solutions package will be a self-assessment instrument for personal use by educators so they can examine their own behaviors to determine whether or not there is room for improvement in providing equity in computer use to students. Our final step in the study will be to field test the ideas and disseminate the package to school districts.

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